The Cognitive Domain: In the following table are the two primary existing taxonomies of cognition. The one on the left, entitled **Bloom's**, is based on the original work of Benjamin Bloom and others as they attempted in 1956 to define the functions of thought, coming to know, or cognition. This taxonomy is over 50 years old.

The taxonomy on the right is the more recent adaptation and is the redefined work of one of Bloom's former students, Lorin Anderson, working with one of Bloom's partners in the original work on cognition, David Krathwohl. That one is labeled **Anderson and Krathwohl.**  The new taxonomy was a larger group effort lead by Anderson and Krathwohl as they worked on this task from from 1995-2000. The group was assembled by the primary authors and included people with expertise in the areas of cognitive psychology, curriculum and instruction, and educational testing, measurement, and assessment.

As you will see the primary differences are not just in the listings or rewordings from nouns to verbs, or in the renaming of some of the components, or even in the repositioning of the last two categories. The major differences in the updated version is in the more useful and comprehensive additions of how the taxonomy intersects and acts upon different types and levels of knowledge -- factual, conceptual, procedural and metacognitive.

Taxonomies of the Cognitive Domain:

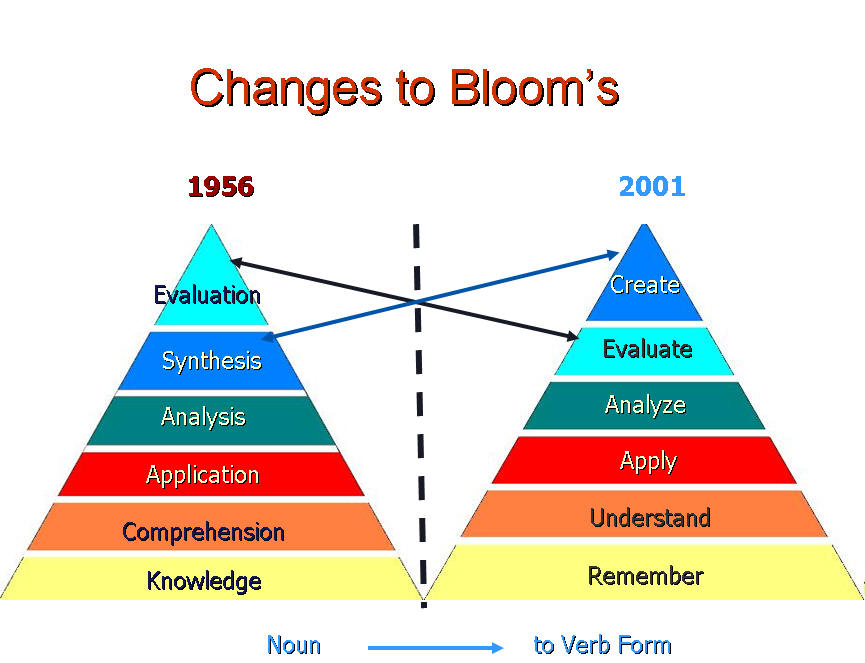
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| --- | --- |
| Bloom's Taxonomy 1956 | Anderson and Krathwohl's Taxonomy 2000 |
| 1. Knowledge: Remembering or retrieving previously learned material. Examples of verbs that relate to this function are:   |  |  |  | | --- | --- | --- | | know  identify  relate  list | define  recall  memorize  repeat | record  name  recognize  acquire | | 1. Remembering: Retrieving, recalling, or recognizing knowledge from memory. Remembering is when memory is used to produce definitions, facts, or lists, or recite or retrieve material. |
| 2. Comprehension: The ability to grasp or construct meaning from material. Examples of verbs that relate to this function are:   |  |  |  | | --- | --- | --- | | restate  locate  report  recognize  explain  express | identify  discuss  describe  review  infer  conclude | illustrate  interpret  draw  represent  differentiate | | 2. Understanding:  Constructing meaning from different types of functions be they written or graphic messages activities like i**nterpreting, exemplifying, classifying, summarizing, inferring, comparing, and explaining.** |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 3. Application: The ability to use learned material, or to implement material in new and concrete situations. Examples of verbs that relate to this function are:   |  |  |  | | --- | --- | --- | | apply  relate  develop  translate   use   operate | organize  employ  restructure  interpret  demonstrate  illustrate | practice  calculate  show  exhibit  dramatize | | 3. Applying:  Carrying out or using a procedure through **executing, or implementing**. Applying related and refers to situations where learned material is used through products like models, presentations, interviews or simulations. |
| 4. Analysis: The ability to break down or distinguish the parts of material into its components so that its organizational structure may be better understood. Examples of verbs that relate to this function are:     |  |  |  | | --- | --- | --- | | analyze  compare  probe  inquire  examine  contrast  categorize | differentiate  contrast  investigate  detect  survey  classify  deduce | experiment  scrutinize  discover  inspect  dissect  discriminate  separate | | 4. Analyzing:  Breaking material or concepts into parts, determining how the parts relate or interrelate to one another or to an overall structure or purpose. Mental actions included in this function are **differentiating, organizing, and attributing**, as well as **being able to distinguish between** the components or parts. When one is analyzing he/she can illustrate this mental function by creating spreadsheets, surveys, charts, or diagrams, or graphic representations. |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 5. Synthesis: The ability to put parts together to form a coherent or unique new whole. Examples of verbs that relate to this function are:   |  |  |  | | --- | --- | --- | | compose  produce  design  assemble  create  prepare  predict  modify  tell | plan  invent  formulate  collect  set up  generalize  document  combine  relate | propose  develop  arrange  construct  organize  originate  derive  write  propose | | 5. Evaluating:  Making judgments based on criteria and standards through **checking and critiquing**. Critiques, recommendations, and reports are some of the products that can be created to demonstrate the processes of evaluation.  In the newer taxonomy evaluation comes before creating as it is often a necessary part of the precursory behavior before creating something.  icture (12x12, 308 bytes)**Remember this one has now changed places with the last one on the other side.** |
| 6. Evaluation: The ability to judge, check, and even critique the value of material for a given purpose. Examples of verbs that relate to this function are:   |  |  |  | | --- | --- | --- | | judge  assess  compare  evaluate  conclude  measure  deduce | argue  decide  choose  rate  select  estimate | validate  consider  appraise  value  criticize  infer | | 6. Creating: Putting elements together to form a coherent or functional whole; **reorganizing** elements into a new pattern or structure through **generating, planning, or producing**. Creating requires users to put parts together in a new way or synthesize parts into something new and different a new form or product.  This process is the most difficult mental function in the new taxonomy.  icture (12x12, 308 bytes)**This one used to be #5 in Bloom's known as synthesis.** |

Table 1.1  Bloom vs. Anderson/Krathwohl

Visual comparison of the two taxonomies



One of the things that clearly differentiates the new model from that of the 1956 original is that it lays out components nicely so they can be considered and used, and so cognitive processes as related to chosen instructional tasks can be easily documented and tracked. This feature has the potential to make teacher assessment, teacher self-assessment, and student assessment easier or clearer as usage patterns emerge.

Perhaps surprisingly, these levels of knowledge were indicated in Bloom's original work - ***factual, conceptual, and procedural*** - but these were never fully understood or used by teachers because most of what educators were given in training consisted of a simple chart with the listing of levels and related accompanying verbs. The full breadth of *Handbook I* and its recommendations on types of knowledge were rarely discussed in any instructive or useful way. Nor were teachers in training ever made aware of any of the criticisms leveled against the original model. Please note that in the updated version the term "***metacognitive***" has been added to the array of knowledge types.

Here are the intersections as the processes impact the levels of knowledge. Using a simple cross impact grid or table like the one below, one can match easily activities and objectives to the types of knowledge and to the cognitive processes as well. It is a very useful tool to use in assessing how instruction is actually impacting levels of learning. Teachers can also use it to track which levels of cognition they are requiring from students, as well as which dimensions of knowledge.

Cognitive Processes

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| The Knowledge Dimensions | 1.Remember | 2.Understand | 3. Apply | 4. Analyze | 5. Evaluate | 6. Create |
| Factual |  |  |  |  |  |  |
| Conceptual |  |  |  |  |  |  |
| Procedural |  |  |  |  |  |  |
| Metacognitive |  |  |  |  |  |  |

**Knowledge Dimensions Defined:**

Factual Knowledge is knowledge that is basic to specific disciplines. This dimension refers to essential facts, terminology, details or elements students must know or be familiar with in order to understand a discipline or solve a problem in it.

Conceptual Knowledge is knowledge of classifications, principles, generalizations, theories, models, or structures pertinent to a particular disciplinary area.

Procedural Knowledge refers to information or knowledge that helps students to do something specific to a discipline, subject, area of study. It also refers to methods of inquiry, very specific or finite skills, algorithms, techniques, and particular methodologies.

Metacognitive Knowledge is the awareness of one�s own cognition and particular cognitive processes. It is strategic or reflective knowledge about how to go about solving problems, cognitive tasks, to include contextual and conditional knowledge and knowledge of self.